Zur Theorie der Elektronenstrahlröhren
mit periodischem Aufbau

VON DER
EIDGENÖSSISCHEN TECHNISCHEN HOCHSCHULE IN ZÜRICH
ZUR ERLANGUNG DER WÜRDE EINES
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Summary

The motion of a cylindrical electron beam along a periodical sequence of conductors is treated by means of the Maxwell-Lorentz field theory. The periodicity of the boundary conditions requires a second-order difference equation to be satisfied by the influenced wall currents.

Another second-order difference equation for these currents is obtained, in a purely formal way, using the theory of three-terminal-pair junctions. A variational method applied to an integral equation resulting from the field theory is mentioned to be suitable for the justification of this procedure.

The coexistence of these two difference equations leads to a transcendental equation, the universality of which is illustrated by the following examples.

a) The gain of a tuned multi-cavity klystron is obtained.
b) The well known theory of the synchronous traveling-wave tube is shown to be a limiting case. It appears that a term which is independent of the slow-wave structure, modifies the Pierce space-charge parameter.
c) The forward gain of the subsynchronous traveling-wave tube is discussed, especially in view of the stability under high current conditions.